REMARKS

Claims 1-20 are all the claims pending in the application. Claims 3-4 were withdrawn from consideration pursuant to a restriction requirement of July 31, 2001 and the election of August 20, 2001. This Amendment amends claims 1 and 12, cancels claims 9 and 18, and addresses each point of rejection raised by the Examiner. Favorable reconsideration is respectfully requested.

Applicants thank the Examiner for the explanation offered in the Remarks section of the Office Action.

The Office Action does not indicate that claim 20 is pending, nor is any rejection offered against claim 20. Claim 20 depends from claim 19, and was added in the Amendment of December 18, 2002. Examination of claim 20 is respectfully requested. Applicants submit that if claim 20 is rejected on the merits in a future action, that any such rejection must be made non-final.

Claim Rejections - 35 U.S.C. § 112, Second Paragraph

The Examiner rejects claims 1-2 and 5-19 as being indefinite. Specifically:

> *Regarding Claims 1 and 11, and all claims that depend therefrom it is not clear 1) if the entire active region is formed of InGaAsP as claimed, 2) what part of the upper cladding layer is removed in relation to the remainder of the semiconductor laser, i.e. at the peripheral of the device, etc., and 3) what the configuration of the cladding layer is after the upper waveguide is removed, i.e. a ridge structure as claimed in Claim 2.*

In addition, to overcome indefiniteness issues, the claimed subject matter must include the structural details of the cladding/waveguide interface that the Applicant has disclosed as part of the claimed invention.

Regarding point (1), claim 1 required "an active region *which includes* at least a quantum well layer and upper and lower optical waveguide layers on opposite sides of the at least a quantum well layer, the active region being formed of $In_xGa_{1-x}As_yP_{1-y}$ ($0 \leqq x \leqq 1$, $0 \leqq y \leqq 1$)" (emphasis added).

While Applicants contend that this is clear on its face, Applicants have amended claim 1 to replace "active region" with the recited layers of the active region. Claim 1 now recites: "an active region which includes at least a quantum well layer and upper and lower optical waveguide layers on opposite sides of the at least a quantum well layer, the ~~active region~~ quantum well layer, the upper optical waveguide layer, and the lower optical waveguide layer each being formed of $In_xGa_{1-x}As_yP_{1-y}$ ($0 \leqq x \leqq 1$, $0 \leqq y \leqq 1$)." Applicants note that this amendment effectively broadens the claim 1.

The Examiner also cites claim 11, which depends from claim 10, which depends from claim 1, and requires that "said part of the upper cladding layer on the upper optical waveguide layer which is selectively removed is outside said stripe, said upper cladding layer forming a mesa stripe structure and said semiconductor laser being of a ridge waveguide type." As claim 11 depends from claim 1, the changes above also apply to claim 11 in accordance with 35 U.S.C. § 112, paragraph four.

Additionally, Applicants have amended independent claim 12 to replace "active region" in a similar manner as described above for claim 1.

Reconsideration of point (1) is respectfully requested.

Regarding points (2) and (3), Applicants have amended claim 1 to incorporate the subject matter of claim 9, and have amended claim 18 to incorporate the subject matter of claim 12.

Applicants submit that independent claim 1 and dependent claim 11 are clear on their face. Claim 1 is intended to be broad enough in scope to cover not only the various exemplary embodiments of the invention in the specification, but a broader invention as a whole. What part of the upper cladding layer is removed and the particular configuration of the cladding layer is described in various dependent claims, but is not the subject matter required by claim 1.

However broad, claim 1 particularly points out and distinctly claims the subject matter of the invention. The claim requires a semiconductor laser comprising an active region which includes at least a quantum well layer and upper and lower optical waveguide layers. The upper optical waveguide layer and the lower optical waveguide layer are on opposite sides of the at least a quantum well layer. The quantum well layer, the upper optical waveguide layer, and the lower optical waveguide layer are formed of $In_xGa_{1-x}As_yP_{1-y}$. There are upper and lower cladding layers formed AlGaAs on opposite sides of the active region. The upper optical waveguide layer is not smaller than 0.25 μm in thickness. A part of the upper cladding layer on the optical waveguide layer has been selectively removed up to the interface with the upper optical waveguide layer.

Applicants submit that there is no reason to arbtrarily narrow claim 1 to a particular embodiment of the invention, absent the presentation of prior art showing that a broad claiming of the invention is unpatentable. Reconsideration is requested.

Regarding dependent claim 11, Applicants submits that 11 is also definite at least for the reasons offered above for independent claim 1. Moreover, claim 11 does recites additional structure (*e.g.*, ridge waveguide; mesa stripe). Reconsideration is requested.

Additionally, regarding independent claim 12, Applicants submit that the claim is definite for reasons similar to those offered for claim 1. Claim 12 requires a semiconductor laser comprising an active region which includes at least one quantum well layer and upper and lower optical waveguide layers. The upper optical waveguide layer and the lower optical waveguide layer are on opposite sides of the at least one quantum well layer. The quantum well layer, the upper optical waveguide layer, and the lower optical waveguide layer are formed of $In_xGa_{1-x}As_yP_{1-y}$. There are upper and lower cladding layers formed AlGaAs on opposite sides of the active region. The upper optical waveguide layer is not smaller than 0.25 μm in thickness. A current blocking layer is interposed between portions of the upper cladding layer and the upper optical waveguide layer. These portions of the upper cladding layer and the upper optical waveguide layer having the current blocking layer interposed between are along opposite lateral edges of the semiconductor laser. There is an interface of the upper cladding layer and the upper optical waveguide layer adjacent to the portions of the upper cladding layer and the upper optical waveguide layer having the current blocking layer interposed between.

As with claim 1, Applicants submit that claim 12 is definite on its face. Applicants submit that there is no reason to arbtrarily narrow claim 12 to a particular embodiment of the invention, absent the presentation of prior art showing that a broad claiming of the invention is unpatentable. Reconsideration is requested.

Claim Rejections - 35 U.S.C. § 112, Second Paragraph

The Examiner rejects claims 1-2 and 5-19 as being incomplete for omitting essential structural cooperative relationships between elements. Specifically, the Examiner states:

> *The omitted structural cooperative relationships are: 1) the thicknesses of the waveguide and cladding layers that enable the selective removal of the waveguide layer to the cladding layer interface and 2) the relationships of the cladding and waveguide layers, i.e. as discussed above.*

Regarding point (1), as noted above, Applicants have amended independent claims 1 and 12 to incorporate the subject matter of claims 9 and 18, respectively. As explained, for example, on page 9, lines 11-14, when the thickness of the upper optical waveguide layer is not smaller than 0.25μm, deterioration in crystallization does not occur even if the cladding layer is removed up to the optical waveguide layer.

Regarding point (2), as discussed above, the particular relationships between the cladding and waveguide layers are already identified in the claims. Claims 1 and 12 already recite an interface between the upper cladding layer and the upper waveguide layer, and the relative positions of all of the layers. In the present invention, since the waveguide layer is made of InGaAsP and the cladding layer is made of AlGaAs, these two layers have different chemical characteristics. Consequently, it is possible to selectively etch only the cladding layer made of AlGaAs. Therefore, the thickness of the cladding layer which is selectively etched is not an essential component of the present invention. Rather, as a result of the having the upper optical waveguide layer that is not smaller than 0.25μm in thickness, having a thin cladding layer is an option, but not a requirement. *See* page 10, line 21 to pate 11, line 7 (*using* phrases like "may be

reduced" and "can be reduced"). Accordingly, Applicants submit that the claims are definite. Reconsideration is respectfully requested.

Claim Rejections under 35 U.S.C. § 103(a)

Claims 1-2, and 5-19 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over "Applicant's Prior Art" and in view of U.S.P. 5,982,804 to *Chen et al.* ("Chen").

The Examiner cites Fig. 8 of Chen for selective removal of the cladding layer. The cladding layer is selectively etched to form gratings 20.

In essence, the Examiner is asserting that the teachings regarding the grating 20 of Chen would be relevant to a structure having AlGaAs cladding layer.

Chen is related to fabricating a semiconductor laser made of InP/InGaAsP. In comparison, the claimed invention is related to fabricating a semiconductor laser made of AlGaAs/InGaAsP.

One of the characteristic features of the present invention lies in etching a part of a layer made of AlGaAs which includes Al, in order to expose a part of an interface of a layer made of InGaAsP. With this structure of the present invention, the area of an interface of the AlGaAs (which is easily oxidized) that is exposed can be precisely controlled (*i.e.*, a small interface area can be selectively obtained), affording improved process control and realizing a semiconductor laser having high quality and reliability.

If the semiconductor laser has a layer which is made of AlGaAs and which has a large exposed surface area, such as a grating, the quality of the semiconductor laser is degraded due to the largeness of the area which is oxided. Therefore, it is not desirable to have a large exposed

area for a layer made of AlGaAs. Accordingly, there would be no reason to look to Chen for teachings regarding the AlGaAs cladding layer.

Further, the Examiner is relying on column 8, line 20 of Chen, which discloses that the waveguide layer 111 has a thickness equal to 0.45 μm. It is clear that this "waveguide layer 111" is an SCH structure, including upper and lower waveguides, and a quantum well. In every figure illustrating the SCH structure, Chen illustrates the upper and lower waveguide layers as symmetric, and no motivation is offered for constructing the device in any other fashion.

Assuming the quantum well is of negligible thickness, for an SCH structure having a thickness of 0.45 μm, the individual waveguide layers are approximately 0.22 μm each, such that no waveguide layer "is not smaller than 0.25 μm in thickness."

If it is the Examiner's position that somehow layer 111 is not an SCH structure, then Applicants respectfully point out that the result of such a misconstruction is that there is no active layer, and the claim requirements still are not suggested. Further, by applying a thickness from Fig. 18 to the structure of Fig. 8, the Examiner has mixed separate embodiments of Chen without offering any motivation to do so.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,

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